UNIVERSITI TEKNOLOGI MARA

NUMERICAL ANALYSIS ON THE EFFECT OF UPSTREAM BUILDING ARRANGEMENT AND SETBACK DISTANCE ON PEDESTRIAN WIND ENVIRONMENT

MUHD AZHAR BIN ZAINOL

Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Mechanical Engineering

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 20th March 2017 to conduct the final examination of Muhd Azhar bin Zainol on his Master of Science thesis entitled "Numerical Analysis on the Effect of Upstream Building Arrangement and Setback Distance on Pedestrian Wind Environment" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

The development of high rise buildings had been shifting to sub-urban area due to the limitation of space and increasing property prices in the urban area. The growth of this development in sub-urban area might affect the mean wind velocity and flow structure in the urban area. Apart from that, the vegetation area such as tree and hills areas were replaced with development of high rise buildings with large podium bulk, were unfavourable to natural ventilation and could reduce the mean wind velocity at urban area and also reduce the distance between sub-urban area and urban area. Therefore, it was important to investigate the impact of sub-urban building geometry and the distance between sub-urban area and urban area on the mean wind velocity profile and flow structure at the urban area. Due to this circumstance, large eddy simulation (LES) was performed to evaluate the effect of sub-urban building geometry on mean wind velocity and flow structure over the urban buildings. The sub-urban area was modelled as an upstream building and the urban area was modelled as downstream area. The packing density for both areas was fixed at 25% and the setback distance, d from $3H$, $5H$ and $7H$. Based on the result obtained, the setback distance between the upstream area and downstream area slightly influenced on the flow structure at the downstream area, however longer setback distance provided higher mean wind velocity at downstream area compared to shorter setback distance. In addition, one high rise building and two high rise buildings were added at upstream area with a fixed setback distance $3H$. The current result revealed that as the number of high rise building increase, the mean wind velocity and turbulence statistic (Reynold stress and turbulence intensity) at the downstream area will be decreased. The results gained from this study only demonstrated the effect of group buildings with two types of building arrangements. The findings in this study might be important to town planners and architects to get a better understanding of the influences of setback distance and upstream building configurations in the urban ventilation study.

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